

MIDDLE DEVONIAN CORALS FROM THE BUCHAN DISTRICT, VICTORIA

By DOROTHY HILL, D.Sc.,
University of Queensland, Brisbane
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Abstract

The fossil corals of the Buchan district, Victoria, are described and figured, including five new species of Rugosa and six of Tabulata, and the age of the Buchan Series deduced to be Couvinian. The occurrence of squamulae in the Favositidae is discussed, and the types found in the Buchan favositids described, with notes on the wall structure in *Favosites*.

Stratigraphic Palaeontology

The dominant Rugose coral families in the Buchan series are the *Acantho-phyllidae* and *Disphyllidae*; and this shows that the series is Lower or Middle Devonian. Since the use without definition of these terms 'lower' and 'middle' results only in confusion, my definitions follow. My use of the Lower Devonian Stages is that of Asselberghs (1946), who has studied their priority of nomenclature. For the Middle Devonian Stages I follow Maillieux (see Lecompte, 1939, p. 6).

| Epoch | Stage | Sequence in the south of the Dinant Basin |
|-----------------|--|---|
| Middle Devonian | Givetian | { Assise de Givet (<i>Stringocephalus</i> beds) |
| | Couvinian | { Assise de Couvin (<i>Calceola</i> beds) Assise de Bure (<i>Spirifer cultri- jugatus</i> beds) |
| Lower Devonian | Emsian, Dorlodot, 1900, p. 157 | { Grauwacke de Hierges (lower part) Schistes et grès de Winenne Grès et schistes de Vireux Grauwacke de Pesche |
| | Coblenzian, Dumont, 1848, p. 21 (= Siegenian of Dorlodot, 1900, p. 157, as used by Asselberghs, 1946) | { Hundsruckian = Grauwackes de Petigny et St. Michel Taunusian = Grès d'Anor |
| | Gedinnian, Dumont, 1848, p. 4 | { Schistes de St. Hubert à Poudingue de Fépin |
| | | |

The Buchan series has been described by Teichert (1948, p. 60) as consisting of between two and three thousand feet of limestones and shales, and from his field mapping and collections three coral faunas may be recognized, which can be considered in relation to the standard sequence. These are, from below up, the Cave limestone fauna, the lower Murrindal fauna (associated with *Gyroceratites* and *Lobobaetrites*), and the upper Murrindal fauna.

The CAVE LIMESTONE coral fauna includes *Acanthophyllum acquiseptatum* Hill, *A.* sp., '*Campophyllum*' *recessum* Hill (very abundant), *Disphyllum speleanum* sp. nov., *Pseudamplexus* ?*princeps* Eth., *Favosites bryani* Jones, *Thamnopora alterivalis* (Chapman), *Aulopora* cf. *conglomerata* Goldfuss, *Syringopora flaeida* sp. nov., and *Roemeria* sp. The Acanthophyllids are most like those from the limestones of Chaudefonds and Chalones, which are reasonably regarded as the Hercynian (Bohemian) facies of the Assise de Bure. The Disphyllid has no close overseas resemblances, while the *Pseudamplexus* is like that from the Emsian Hercynian limestone of Erbray. *F. bryani* has squamulae of a type seen in the Onondagan of North America and the Couvinian of Europe. *T. alterivalis* may be a member of the European *T. reticulata* group, and from the progressive changes in this group outlined by Lecompte it would seem to be older than upper Couvinian. *A. conglomerata* Goldfuss is Middle Devonian in Europe. The remaining Tabulata are not specially indicative of horizon. Direct comparison with European faunas indicates a horizon somewhere near the junction between Emsian and Couvinian, probably Couvinian. The whole fauna is closely related to the Murrumbidgee fauna of N.S.W., previously deduced to be Couvinian (Hill 1940c).

The coral fauna of the LOWER MURRINDAL beds includes *Lyriellasma* aff. *floriforme* Hill, *Disphyllum angulare* sp. nov., *Metriophyllum erisma* sp. nov., *Syringaxon radiatum* sp. nov., *Spongophyllum murale* sp. nov., *Favosites* ? *pluteus* sp. nov., *Gephuropora duni* Etheridge, *Thamnopora alterivalis*, *T.* ? *angulata* sp. nov., *T. tumulosa* sp. nov., and *Aulopora* cf. *conglomerata*. The fauna is largely of argillaceous-calcareous facies. *L. floriforme* occurs in the Tamworth district of N.S.W. in a limestone either Lower Devonian or Couvinian. In Europe *Metriophyllum* is not known before the Assise de Couvin. Neither the Disphyllid nor the Syringaxonid are specially indicative of horizon within the Devonian. *Spongophyllum murale* resembles German Givetian species. *Favosites pluteus* has squamulae of a type found in the Onondagan of North America and the Middle Devonian of Europe. *Gephuropora* is known outside Australia only in the Couvinian of the Ardennes. In N.S.W. it occurs in the Murrumbidgee Series (Couvinian). *T. alterivalis* is similar to the European Middle and Upper Devonian *T. reticulata*; *T. angulata* is perhaps closest to the long-ranged European *Thamnopora polyforata* from the Upper Couvinian and Givetian of the Ardennes. The age indicated by this assemblage is thus probably Couvinian.

The UPPER MURRINDAL coral fauna includes *Acanthophyllum* cf. *clermontense* Hill, *Xystriphyllum mitchelli* (Etheridge), *Disphyllum angulare*, *Metriophyllum* (?) *erisma*, *Alveolites stamineus* sp. nov., *Alveolites* sp., '*Coenites*' *expansus* de Koninck, *Favosites nitidus* Chapman, *F. bryani*, *F. stelliformis* (Chapman), *F. pluteus*, *Gephuropora duni*, *Thamnopora angulata* and *Roemeria ocellata* sp. nov. — *A. clermontense* resembles the Eifel upper Couvinian Acanthophyllids in internal structure; *Xystriphyllum mitchelli* is not unlike *X. manipulatatum* (Pocta) from the Upper Coblenzian or Lower Emsian Koneprus limestone of Bohemia. *Alveolites*

stamineus shows wall thickening characteristic of Devonian forms. '*Coenites*' *expansus* has resemblances to the European upper Couvinian and lower Givetian '*Coenites*' *escharoides*. *F. nitidus* has close similarity of internal structure to *F. alpina* Hörnes in Penecke from the Emsian of Graz. *F. bryani*, *F. stelliformis* and *F. pluteus* all have squamulae of types characteristic of the Onondagan of North America and the Couvinian of Europe; *Gephuropora duni* suggests the Couvinian; *Thamnopora angulata* is possibly related to the Middle Devonian European *T. polyforata* group, and *Roemeria ocellata* is similar to but larger than the Middle Devonian European genotype. Several of these species are characteristic of the Murrumbidgee series of N.S.W., considered to be Couvinian, e.g., *X. mitchelli*, '*C.*' *expansus*, *F. nitidus*, *F. bryani*, *F. pluteus* and *G. duni*, while *F. stelliformis* is known elsewhere only from the Loomberah limestone (possibly Couvinian) of the Tamworth district of N.S.W. It seems likely then, that the upper Murrindal beds are Couvinian, probably upper Couvinian.

The age indicated for the Buchan beds by the corals it contains is therefore Couvinian. The Buchan beds would appear to be roughly equivalent to the Murrumbidgee beds of N.S.W., while the Clermont limestone of Queensland is possibly equivalent to the upper Murrindal beds.

ZOANTHARIA RUGOSA

Family ACANTHOPHYLLIDAE Hill, 1939a, p. 56; 1940, p. 250

Genus *Acanthophyllum* Dybowski; Hill, *idem*.

Acanthophyllum aequiseptatum Hill, 1940, p. 251

(Pl. V, fig. 1)

G.S.V.¹ 47765 from the Cave limestone of Loc. 97* is very like the Couvinian type of this species from the Bluff limestone of the Murrumbidgee series; its tabularium is however slightly wider, one third instead of one quarter the diameter of the corallite, and has some of its axial septal ends slightly curved.

Acanthophyllum sp.

(Pl. V, fig. 2)

G.S.V. 47713-4 from the *Spirifer* (= Cave) limestone of Loc. 82 differ from the Couvinian *A. aequiseptatum* in having the axial ends of their major septa long, somewhat dilated, tightly packed and twisted vortically.

Acanthophyllum aff. *clermontense* (Etheridge); Hill, 1939a, p. 57

(Pl. V, figs. 3a, b)

G.S.V. 48508 (Loc. 225) from the upper reef limestone in the upper Murrindal beds, and 48448 (Loc. 190) from somewhere in the middle of the Murrindal beds differ from the Couvinian types of this species from Clermont, Queensland, in having their septa more regularly thickened in the dissepimentarium, and their tabularium dominated by a few of the axial ends of the major septa which are longer and thicker than the others. It is probable that this characteristic is of specific value but my material is too scanty for certainty. This type of axial septal arrangement is seen in German species such as '*Rhopalophyllum*' *fibratum* Wdkd. from the upper Couvinian.

1. Geological Survey of Victoria collection.

* For details of localities see p. 160.

Genus *Lyriellasma* Hill, 1939b, p. 243

Lyriellasma aff. *floriforme* Hill

(Pl. V, figs. 4a, b)

Lyriellasma floriforme Hill, 1942c, p. 146. Holotype, Syd. Univ. 7252, from the lower Devonian or possibly Couvinian limestone in middle of south boundary Portion 277, Parish Burdekin, Tamworth district, N.S.W.

G.S.V. 48129 (Loc. 167) and 48460 (Loc. 233) from the Murrindal beds have a compound, fasciculate corallum, a ring of new corallites arising by peripheral increase from the dissepimentarium of a mature corallite; the new corallites are of small diameter at first (3 mm. or less) but rapidly widen to at least 14 mm. Where the corallites are crowded in the ring above their origin they become partly prismatic through mutual pressure. There are 18 major and 18 minor septa at a diameter of 6 mm., 22 of each at 12 mm., and 28 at 14 mm. They are dilated and in contact at the periphery to form a stereozone which may be up to 1 mm. in width, but is usually less, and is sometimes insignificant. The major septa are unequal but many attain the axis, and in the tabularium they are carinate. The minor septa are about two-thirds as long as the major. The dissepiments are steeply inclined, even the outermost series, and rather large. The tabularium is about 4.5 mm. wide in a corallite of 12 mm. diameter, and the tabular floors are funnel-shaped with a deep axial notch.

The Tamworth holotype has a narrow, nearly regular peripheral stereozone. In these two Victorian specimens the stereozone is less well marked, and the outer series of dissepiments are more steeply inclined. Since only the holotype is known from Tamworth, and only two specimens from Buchan, the limits of variation are unknown, and the Buchan specimens are provisionally described as *L.* aff. *floriforme*.

Genus *Xystriphyllum* Hill, 1939a, p. 62; 1940c, p. 269

Xystriphyllum mitchelli (Etheridge); Hill, 1940c, p. 269; 1942c, p. 147

(Pl. V, figs. 5, 6)

The species occurs in several localities in the upper Murrindal beds (upper reef limestone), Buchan district, Victoria, e.g., Rocky Camp; north side of hill, north of Rocky Camp; and new road cutting from Buchan township to the Spring Creek Caves, north boundary of allotments 10 and 18, Parish of Buchan.

Family CANINIIDAE

Genus '*Campophyllum*' auctt. Hill, 1940c, p. 254

'*Campophyllum*' *recessum* Hill, 1940c, p. 254

(Plate V, figs. 7, 8)

Campophyllum gregorii Chapman, 1912, p. 219, pl. XXXIV; non Etheridge, 1892.

This species, whose type locality is Devil's Elbow in the Couvinian Murrumbidgee beds, is prolific almost to the exclusion of others, in the Cave limestone in Spring Creek, Caves Reserve, Buchan. Fragmentary material from the Cave limestone of Loc. 97 and the equivalent *Spirifer* limestone of Locs. 13 and 36 is doubtfully referred to this species. In addition, fragmentary material (G.S.V. 48207B and 48212) from the Murrindal beds of Loc. 177 which I have for the present doubtfully included in *Disphyllum angulare* may be related to '*C.*' *recessum*.

Family DISPHYLLIDAE; Hill, 1939b, p. 224

Genus *Disphyllum* de Fromentel

Disphyllum de Fromentel; Lang and Smith, 1935, p. 544; Hill, 1940b, p. 398;
Hill, 1942a, p. 247; Hill, 1942d, p. 185.

Disphyllum speleanum sp. nov.

(Pl. VI, figs. 9a, b)

Holotype. G.S.V. 47763B, from the Cave limestone, Loc. 96 Couvinian. No other specimen known.

Diagnosis. Slender, phaceloid *Disphyllum* with long septa dilated in the tabularium; with up to six series of small, highly globose dissepiments, and flat tabulae.

Description. The corallites are 5 or 6 mm. in diameter and epithecate; increase is axial, several new corallites arising simultaneously. There are 15 to 19 septa of each order, the major septa reaching unequally almost to the axis. The minor septa extend about half way to the axis. Both orders are dilated in the dissepimentarium and frequently close the interseptal loculi; as seen in vertical section they consist of trabeculae arranged in two zones; in a narrow outer zone these are directed upwards and inwards, in a wide inner zone (still in the dissepimentarium) they are arranged like a fan, directed dominantly upwards but falling outwards on the outer side and inwards on the inner side. In the tabularium the major septa are less and irregularly dilated and are somewhat wavy. The dissepiments are very small and globose or elongated in the vertical plane and arranged somewhat irregularly in three to six series. The tabulae are horizontal, thin and close.

Remarks. The species differs from *D. mesa* Hill (1942d, p. 185) from the late lower Devonian Garra beds of N.S.W. in having flat, not mesa-shaped tabulae, and in having smaller dissepiments developed in more series. There are no close resemblances to overseas species.

Disphyllum angulare sp. nov.

(Pl. VI, figs. 10a-c)

Holotype. G.S.V. 48079, lower Murrindal beds, Loc. 156, Couvinian.

Diagnosis. Solitary or compound *Disphyllum* with minor septa withdrawn in adult stages, leaving dissepiments arranged in an angular irregular herringbone pattern as seen in transverse section.

Description. The corallum is solitary or the corallites are aggregated in a manner suggesting a phaceloid or cerioid corallum, though the type of increase is unknown. The individual corallites are trochoid or cylindrical with a trochoid early stage, and may attain a diameter of 20 mm. Their epitheca shows transverse growth striation, and narrow vertical grooves at the position of major and minor septa, separated in the distal parts of the corallite by broad flat regions which may have a narrow median vertical channel.

There are 23 septa of each order at a diameter of 10 mm., increasing to about 30 at 20 mm. The major septa are long and are directed towards an excentric axis, but stop short of this, leaving an empty space 2 to 3 mm. wide; their axial ends may be slightly curved as they approach this space. The minor septa are short, and project but little inside a peripheral stereozone 1 to 1.5 mm. wide, formed by

the septa of both orders becoming dilated and by the deposition of tissue on the upper surfaces of the dissepiments between them. The tabularium is very wide, and the sagging tabulae are reinforced at its margin by numerous small plates closely resembling dissepiments, which meet at an angle in the loculi between the major septa; or are themselves angulate, the elbow being directed outwards in transverse section. There are one or two vertical series of dissepiments in the peripheral stereozone, and the dissepiments are globose and thickened by the upward growth of their constituent fibres.

Localities. This species has been collected from three localities in the Murrindal beds. In addition to the type locality it is known from the lower Murrindal beds of Loc. 145 and the upper Murrindal beds of Loc. 177.

Family METRIOPHYLLIDAE Hill, 1939c, p. 143

Genus **Metriophyllum** Edwards and Haime; Hill, 1939c, p. 144

Metriophyllum erisma sp. nov.

(Pl. VI, figs. 11, 12)

Holotype. G.S.V. 48901 (specimen reduced to a thin vertical section), Loc. 167, lower Murrindal beds, Couvinian.

Diagnosis. *Metriophyllum* with septal flanges inclined inwards and downwards, and with the inner tabulae sweeping vertically downwards about the axial structure.

Description. The corallum is almost cylindrical in its distal part, increasing in diameter from 4 mm. to 6 mm. in 8 mm. The major septa are 18 in number at a diameter of 5 mm. They meet at the axis of the corallum, forming a dense axial structure 2 to 3 mm. wide. Their sides are flanged, by slender, straight, plate-like outgrowths of septal tissue, which are directed downwards and inwards from the periphery, at a moderate angle as seen in median vertical section; in transverse section these appear as thickenings of the septa, or as slender plates like extra septa, running parallel to the septa. The thickness of the septa is variable from one section to another. Minor septa are not developed or are buried in the peripheral stereozone. The tabulae bound the axial structure by descending almost vertically around it; occasional outer tabulae proceed from the structure downwards and outwards to the periphery. There are no dissepiments.

Occurrence. The species characterizes the nodular Murrindal beds, specimens having been collected from Localities 3 and 55, in addition to the type locality.

Remarks. I am unconvinced by the evidence accepted by Smith (1945, pl. 34, fig. 3) for the identity of *Lopholasma carinatum* Simpson and *Stereolasma rectum* Hall, and regard only *L. carinatum* as congeneric with *Metriophyllum*.

Family MYCOPHYLLIDAE Hill, 1940a, p. 156

Genus **Pseudamplexus** Weissmerl; Hill, 1940a, p. 157

Pseudamplexus princeps (Etheridge); Hill and Jones, 1940, p. 185

Only one specimen is known from the Buchan district—Melb. Univ. specimen C.Q.6 from Caves road quarry; its peripheral stereozone and the number of septa are as in the Lower Devonian types of the species, but as it is not certain that the Victorian form can be sub-compound like typical *princeps* it is included only doubtfully.

Family SPONGOPHYLLIDAE Hill, 1939a, p. 58; 1942a, p. 254

Genus *Spongophyllum* Edwards and Haime; Hill, 1939a, p. 60

Spongophyllum murale sp. nov.

(Pl. VI, figs. 13a, b)

Holotype. F.10272 Univ. of Q'ld. coll.; locality uncertain, probably Martin Cameron's quarry, Buchan. Dr. Teichert regards this quarry as in a bioherm in the lower Murrindal beds. Couvinian.

Diagnosis. Phaceloid *Spongophyllum* with very slender corallites with a wide peripheral stereozone.

Description. The corallum is fasciculate; the individuals, from 2 to 3 mm. in diameter, are somewhat crowded but parallelism of growth is not absolute. There are 12 long, unequal, wavy major septa extending almost to the axis; at the periphery they suddenly dilate to form with the similarly dilated alternating minor septa a stereozone about 0.25 mm. wide, from which however the minor septa do not project. Spines project from the sides of the septa, whose trabeculae are directed upwards and inwards from the wall. Large dissepiments are developed in a single series; though not infallibly, they are globose and lonsdaleoid, the septa frequently being discontinuous across them. The tabulae are thin, sagging plates.

Remarks. The spines on the sides of the wavy septa, the sagging tabulae, the lonsdaleoid dissepiments and the thick peripheral stereozone are all characteristic of the German *S. parvistella* Schlüter, which is however cerioid and is characteristic of the Givetian. There are resemblances also to *Fascicularia conglomeratum* Schlüter, also Givetian, but the lonsdaleoid dissepiments in our species indicate its relationship to *Spongophyllum*.

Family SYRINGAXONIDAE Hill, 1939c, p. 141

Genus *Syringaxon* Lindström, 1882, p. 20; Butler, 1935, p. 117

Genotype (by monotypy), *Cyathaxonia siluriensis* McCoy, 1850, p. 281; Upper Ludlow, Underbarrow, Kendal, Westmorland.

Diagnosis. Small, solitary, conical or cylindrical Rugose corals with an aulos formed by the dilatation of the axial ends of the septa which are withdrawn from the axis, and reinforced by tabular thickening; and a peripheral stereozone formed by dilation of the peripheral ends of the septa; with contratingent minor septa, and without dissepiments; with aular tabulae horizontal and outer tabulae declined from the aulos.

Range. Woolhope Limestone (base of Wenlock) to upper Middle Devonian; possibly, however, undescribed specimens in the Sedgwick Museum from the Caradocian Robeston Wathen and Coniston limestones belong to the genus; and Prantl accepts in it a Russian Upper Devonian or Devono-Carboniferous species.

Remarks. The American Niagaran genus *Laccophyllum* Simpson, 1900, and the Bohemian Silurian and Devonian *Alleynia* Pocta, 1902, are usually regarded as identical with *Syringaxon*; the latter certainly shows the characteristic septal dilatation, but the type species of the former (Smith, 1945, pl. 1, fig. 18) is as little dilated as is the genotype of *Barrandeophyllum*, a genus usually regarded as distinct by reason of this less septal dilatation, an irregular aulos, and the development of supplementary tabulae. Although these are differences of degree, they may well have generic significance and the family requires study.

Prantl (1938, p. 25) remarks that the amount of thickening in different specimens of a Middle Devonian Bohemian species of *Syringaxon* is greatest in specimens from shales, and least in specimens from limestone.

***Syringaxon radiatum* sp. nov.**

(Pl. VI, figs. 14, 15)

Holotype. G.S.V. 48113 (thin section only), Loc. 167, lower Murrindal beds, Couvinian.

Diagnosis. *Syringaxon* with a wide peripheral stereozone but little septal dilatation at the narrow aulos, and with numerous septa, the minor being long.

Description. The corallum is conical, increasing in diameter from 5 to 10 mm. in 15 mm. There are 24 major and 24 minor septa at a diameter of 10 mm.; they are all dilated and in contact at the periphery to form an irregular stereozone about 1 mm. wide. The major septa are radial rather than pinnate in arrangement; they are relatively thin between this zone and the zone where the contralingent minor septa abut on them, and thereafter swell slightly but gradually to the aulos, where however the dilatation is less than in most species of the genus; they project slightly inside the aulos, decreasing rapidly to a sharp edge, usually without turning towards one another there. The minor septa are about half as long as the major septa, on which they are contralingent, the pair on either side of the counter septum being a little longer than the others and abutting on the counter septum. Occasional discrete vertical trabeculae are observed at the axis. The trabeculae in the septa are very close together, and are directed upwards and outwards. The dilatation of the septa at the aulos is not always sufficient to form an aulos unaided, and the tube is then completed by thickening of the aular tabulae. The tabulae within the aulos are horizontal or with slightly upturned edges, and are variably distanced—from 0.2 to 1.6 mm. apart; the outer tabulae are steeply declined from aulos to periphery, some being complete, but there are supplementary plates either at the aulos or at the periphery. Occasionally in the distal parts of the corallite a few dissepiments may be developed between one minor septum and its neighbouring major septum, but a continuous dissepimentarium is never formed.

Remarks. Only two specimens are known, both from the same locality. One has been used to give a thin transverse section, and the other to give a vertical section. The species shows much less dilatation than the Silurian genotypes; it retains the peripheral stereozone of the genus, but the dilatation at the aulos is almost as small as in the Middle Devonian *Barrandocoryllum* and the American Niagaran *Laccocoryllum*. None of its features can as yet be recognized as characteristic of the species of any one age.

ZOANTHARIA TABULATA

Family ALVEOLITIDAE Duncan; Leconte, 1939, p. 17

Genus *Alveolites* Lamarck, 1801; Hill, 1936, p. 33. Leconte, 1939, p. 17

***Alveolites stamineus* sp. nov.**

(Pl. VI, figs. 16a, b)

Holotype. Melb. Univ. Coll. 1954, slides 645 and 646. Couvinian, Murrindal, near Buchan, Vic.

Diagnosis. Discoid or laminar *Alveolites* with alveolitoid or semilunar corallites twice as wide as high (0.7 mm. and 0.35 mm.), with walls up to 0.2 mm. thick,

with mural pores 0.2 mm. wide and distant 0.65 mm. from centre to centre on the side walls of corallites; with numerous small spines, especially in the upper walls, and with thin, somewhat irregular tabulae.

Description. The corallum is massive, discoidal or laminar. The number of neighbouring corallites which have a parallel growth is not great, giving the calical surface an appearance of swirling turbulence. The corallites open obliquely, the angle of dip being 50° to 60° . They have an arched upper wall, and the bases of the sides of the arch typically rest on the crests of the arches of two neighbouring lower corallites. The regularity of the arrangement may be overcome, and the corallites then tend to be rectangular in section. The arch is a low one, and is evenly thickened, not produced into an angular projection at the crest. The average width of the corallite between the bases of the arch is about 0.7 mm. (from median line to median line), and the average height 0.35 mm. There are patches in the corallum where the walls are thicker than elsewhere, the maximum observed in such a patch being 0.2 mm. In the thinner-walled patches the thickness of the common walls was 0.1 mm. Each common wall is seen to be made of fibres directed upwards and inwards to the lumen from the median line. Small blunt spines project into the lumen, more from the upper arched wall than from the lower wall. Mural pores are about 0.2 mm. in diameter and their centres are about 0.65 mm. apart. They are developed on the upper wall, but only along the bases of the arch. Tabulae are usually complete, sometimes slightly domed, or saucered or inclined, and unequally spaced.

Range. The species is known also from the upper reef limestone of the upper Murrindal beds of Loc. 225. The thickening of the walls is characteristic of the Devonian alveolitids.

Alveolites sp.

(Pl. VI, figs. 17, 18)

G.S.V. 48507 (Loc. 225) and 48492 (Loc. 230), both from the upper reef limestones in the Couvinian upper Murrindal beds, have much thicker walls than *A. stamineus*. The average dimensions of the corallites are 0.6 x 0.4 mm. (from median line to median line), and the thickness of the wall is 0.2 to 0.3 mm., against 0.1 to 0.2 mm. in *A. stamineus*. Septal spines have not been noted in the few sections available; mural pores are common, at the bases of the upper or arched walls. The tabulae are as in *A. stamineus*.

Genus **Coenites** auctt.; Lecompte, 1939, p. 62

Remarks. *Coenites* Eichwald has as genoelectotype *C. juniperinus* Eichwald from the drift of Vilna, Russia. Nicholson (1879) regarded a species from the Wenlock limestone of Stoke Edith, England, as identical with *C. juniperinus*, and interpreted *Coenites* upon this English form. As no thin sections of the type specimens of *C. juniperinus* are available, one cannot be certain that *Coenites* of Nicholson and other authors is in fact *Coenites* Eichwald. Lecompte has discussed the relation between *Cladopora*, '*Limaria*' and *Coenites*.

Diagnosis. 'Corallum ramose, laminar or massive, but in this last case finely zoned. Corallites conical in very limited development, because of the rapid thickening of the walls, with progressive constriction of the lumen causing precocious senility. Calices semi-lunar or horse-shoe-shaped. Tabulae few. Mural pores rare.

Septa occasionally represented by three processes in the calices.' (Leconte, 1939, p. 62).

'Coenites' expansus de Koninck

(Pl. VI, figs. 19a-c)

Coenites expansus de Koninck, 1876, p. 74, pl. 2, fig. 3, from a very dark, black limestone in the Murrumbidgee Valley, Yass district. Couvinian. [The specimen figured by de Koninck, in which the coral tissue was more resistant to weathering than the limestone, in all probability was derived from the nearly black sponge limestone, of Cavan, in which the coral tissue is replaced by silica and weathers out in relief.]

Non *Coenites expansus* Frech, 1886, which is *Coenites escharoides* Steininger, from the Upper Couvinian and Lower Givetian of the Ardennes and the Eifel (Leconte, 1939, p. 65).

Neotype. Univ. Q'ld. F.4269 (D. Hill Coll.), from the Couvinian sponge limestone of Cavan, N.S.W. The specimen is in black limestone with the coral tissue silicified and standing out in relief.

Diagnosis. Foliaceous Tabulate corals with some reticulation of the foliae, which are 3 or 4 mm. thick; with corallites diverging from a not always median plane to open obliquely on both surfaces of the folia; the walls of the corallites are thickened throughout, but the thickening increases distally. Mural pores and tabulae few.

Description. The corallum is foliaceous, the foliae being undulating and 3 or 4 mm. thick; the growing edge of one folia sometimes abuts the surface of another, so that the corallum is reticulate in a few places. The corallites diverge from a plane within the folia, not necessarily always median, each proceeding upwards nearly in this plane, towards the growing edge of the lamina for some short distance, and then turning suddenly outwards and proceeding to the surface at an angle of about 45°. Each corallite is alveolitoid, i.e., it is reclined, its outer or upper surface forming a low arch, while its lower surface imitates the shape of the corallites below it; the corallites of one layer alternate with those of another. The narrow lumen remains constant in diameter throughout, being little more than 1 mm. from the lower to the upper margin, but the distance from side to side may be twice this or more. The wall increases in thickness gradually from origin to calice. The fibres of the wall are arranged roughly at right angles to the margin of the lumen, and the thickness of the common wall between two lumina is equal to or greater than the height of the lumen. Septal spines have not been distinguished in sections, and no undamaged calices are available for study. The mural pores are just over 0.1 mm. in diameter, and are moderately abundant. Tabulae are rarely seen.

Remarks. The species is represented at Buchan, Victoria, in the Couvinian upper Murindal beds of Loc. 177. It resembles the upper Couvinian and lower Givetian '*Coenites*' *escharoides* in the form of the corallum, but differs in having less contrast between the dilatation of corallite walls in the axial and outer regions. In growth form also it is similar to *Thamnopora foliata* Jones from the Couvinian of Clermont, but this latter species has polygonal rather than alveolitoid corallites. A closely related form occurs in the Couvinian at Weejasper, N.S.W., differing only in having thinner, rather more regular foliae, and in having rather less dilatation in the axial plane of the foliae.

Family FAVOSITIDAE; Lecompte, 1939, p. 80

Genus *Favosites* Lamarck, 1816. Lecompte, 1939, p. 80

Wall Structure in Favosites. Swann (1947, p. 246), in an able discussion of North American Devonian favositids, has considered that a coenozone consisting of calcareous tissue laid down by a coenosarc may appear in some. In such cases he describes the common wall between two corallites as consisting of: (1) peripheral stereozone of corallite A (consisting of fibrous calcite arranged at right angles to the growth lamellae); (2) 'primordial wall' of corallite A (thin, opaque and structureless); (3) coenozone of homogeneous dense appearing calcite, cryptocrystalline, 'not evidently fibrous', with a very strong preferred orientation with the 'c' axis of the crystal vertical. The cryptocrystalline form is in some instances replaced by larger needle-shaped or prismatic crystals that have the same crystallographic orientation; (4) 'primordial wall' of corallite B; (5) peripheral stereozone of corallite B. Had Swann's figures shown this 'coenozone' actually to consist of fibrous calcium carbonate, like the peripheral stereozone and all coral tissue with the exception of the epitheca (Bryan and Hill 1941, p. 80), it would be necessary to accept the idea of the occurrence of a coenosarc in Favositidae. But they do not, and neither does any of the favositid material which I have studied as yet. I suggest that this 'coenozone' in Favositidae may be a fossilization phenomenon, caused by recrystallization along the plane of junction of two sets of fibres, each differently oriented; the crystallization perhaps assisted by the presence of CaCO_3 rich water finding easy access along such planes. A similar phenomenon is seen along the median line of the septa in some of the specimens of the rugose coral genus *Pycnactis* from the Silurian of Britain. On general grounds also I find it difficult to accept the occurrence of a coenosarc in Favositidae. Had it occurred, one would expect evolution to have made play with it, and produced species and genera characterized by different developments of it; but such are not found.

Squamulae. These are horizontal or slightly inclined flat or curved plates projecting with a free inner edge into the lumen of favositid corals; they may be linguiform, or broad and flat and of even thickness, or eaves-like, thickening in a vertical plane towards the base. They were formed of fibrous calcium carbonate (in some cases more than one trabecula is distinguishable), the fibres seemingly being continuous with those of the peripheral stereozone of the wall. Sometimes they bear a very close relation to the mural pores, being developed from the fibrous tissue of their upper and lower rims (e.g., the eaves-like types in the Australian corals described herein, and in *Emmonsia*). At other times they bear no obvious relation to the mural pores, as in the linguiform type developed in the *F. alpenensis* lineage from the Middle Devonian Traverse group of Michigan, so ably described by Swann (1947). Their fibres diverge from their points of origin in the median line of the common wall, and they are thus septal in origin; they were apparently laid down in invaginations in the sides of the base of the polyp.

Squamulae first appeared in the Upper Silurian (Ludlovian) of Asia Minor (Weissermel 1939, pl. 6, figs. 1, 2) in *Emmonsia* sp.; in the Lower Devonian of Bohemia (Pocta 1902, pl. 102, figs. 2, 3) they may be present in *F. intricatus* Barrande; and they are present in the early Couvinian (Co_1) limestone of Chaudes-fords and Chalonnès, France, in *F. ottiliae* Penecke, Le Maitre (1934, pl. VII, figs. 9, 10) and *F. alpina* Hörnes, Le Maitre (1934, pl. VIII, figs. 7-9), and in the upper Couvinian (Co_2) limestone of Dinant, Belgium, in *F. chaetoides* (Lecompte, 1939, pl. XVIII, fig. 15). They are common in favositids and in

Emmonsia of the Onondagan (Couvinian) of North America, while in the Givetian of Europe they characterize *Caliopora*. They are known also in the Lower Carboniferous of Europe in *Emmonsia parasitica* (Smith and Gullick 1925, pl. VIII). They also occur in *Alveolites*, e.g. *A. fornicatus*, of the Couvinian of north-west Europe and Morocco.

Squamulae in *Australian Favosites*. Eaves-like squamulae occur in the following Couvinian *Favosites* in Australia: *F. nitidus*, *F. stelliformis*, *F. murrumbidgeensis* and *F. bryani*. Typically thin septal spines occur in addition to the squamulae, sometimes being very common. Eaves-type squamulae are developed in pairs, back to back, one in the lumen on each side of the mural pore. Each is formed by the projection of the fibrous tissue of the rim, almost invariably the upper rim of the mural pore. Thus near the median line of the wall they are lightly domed, but this curvature decreases towards the free inner end. They thicken upwards and downwards towards their base at the wall. Their fibres radiate from the median line of the wall, and the outer fibres are shorter than the inner, so that the shape in vertical section is that of a rose thorn, usually directed a little upwards. They are broad in transverse section, where they appear as the projection nearly to the axis of the lumen of the fibres of the greater (median) part of the peripheral stereozone. Their fibres may diverge outwards in this section also. In rare cases they may be seen to be composed of two or more trabeculae. These four species possess in common the arrangement of the mural pores in single series in the middle of the walls; the pores are circular in *F. nitidus*, *murrumbidgeensis* and *bryani*, but oval in *F. stelliformis*. Indeed the specific differences between the first three named species are differences only in degree, and they seem to form a related group.

A somewhat different type of squamula, the shelf-type, is seen in *F. pluteus* from the Murrindal beds of Buchan. Here the squamulae do not thicken upwards and downwards towards the base, nor thin towards their inner, free edge, as in the eaves-type, but retain the same thickness throughout. They are less obviously associated with mural pores, and only occasionally show any curving about a pore. They are also wider than the eaves-type. It seems possible, however, that *F. pluteus* may have developed from *F. bryani*.

Favosites nitidus Chapman; Hill and Jones, 1940, p. 198, pl. VI, figs. 3a-c
(Pl. VII, figs. 20a, b)

G.S.V. 48507A from the upper reef limestone of the upper Murrindal beds (Loc. 225), Buchan district, Couvinian, differs from the lectotype (from Cooper's Creek, behind the Copper Mine, Walhalla) in having its septal apparatus almost entirely of very thin, long, close septal spines, horizontal or only slightly inclined upwards. Eaves-like squamulae, which are fairly common in addition to septal spines in the type specimen, are rather infrequent in this Buchan specimen, but as in the type specimen are formed by the greater lateral growth of the fibres from spine centres above the mural pores, so that the spines coalesce into squamulae. Its dimensions are those of the type—the diameter of the polygonal corallites with somewhat rounded angles is 0.5 mm.; the thickness of the common wall is 0.12 mm.; the diameter of the uniserial mural pores is 0.15 mm., their centres being 0.3 to 0.4 mm. apart. Occasionally the pores are biserial and alternating, but this is less common than in the type; sometimes the pores are somewhat oval in the type specimen, but usually they are circular and only circular ones are observed in the Buchan specimen. In the spacing of the tabulae, which are slightly sagging, it is close to the type, 15 as against 13 in 5 mm. The Buchan specimen is a weathered

cylindrical fragment; new corallites arise in it by the growth of a partition across a portion of the lumen of an old corallite, frequently including two angles, in a type of peripheral increase. Its external structure has close similarity to *F. alpina* Hörnes in Penecke (1894, pl. IX, figs. 13, 14) from the Emsian *barrandei* beds of Graz.

I have two specimens from the Bluff Limestone of Clear Hill, Cavan, Murrumbidgee River, N.S.W., in which squamulae are more numerous than discrete spines. The Clermont (Q.) specimen figured by Jones (1941, pl. 1, fig. 2) also resembles the lectotype more closely than does the Buchan specimen. Univ. Q'ld. F.316 from Toongabbie, Victoria, resembles the Buchan specimen very closely in the important development of discrete septal spines.

Etheridge's (1899, pl. XXVII, figs. 1, 2) *F. basaltica* var. *salebrosa* from the Woolomol limestone of Tamworth, N.S.W., has, like *nitidus*, corallites of 0.5 mm. in diameter, and mural pores in a single vertical series on each corallite face, but in its holotype the corallites are frequently alveoloid, the pores are about 0.75 mm. apart, and squamulae have not been observed.

F. nitidus bears sufficient resemblance to *F. stelliformis* as to suggest relation between the two.

Favosites stelliformis (Chapman)

(Pl. VII, figs. 21, 22)

Chaetetes stelliformis Chapman, 1918, p. 393, pl. XLII, figs. 1-3.

Whereabouts of type specimen and figured thin sections unknown. One thin vertical section, marked 'Dupl.' in Chapman's writing, is in W. N. Benson's Collection. Loomberah Limestone, possibly Couvinian, Tamworth district.

Diagnosis. *Favosites* with polygonal corallites 0.5 mm. in diameter with a single median series of large oval pores on each face, each pore of a series separated from its neighbour by a narrow horizontal eaves-like squamula; with the tabulae tending to be developed at the same levels throughout the corallum.

Description. The corallum is massive, probably hemispherical, with the corallites absolutely straight in course, and about 0.5 mm. in diameter. They are polygonal, the angles are not rounded, and the walls are about 0.05 mm. thick; gaps are frequently present in the walls in transverse section owing to the frequency of the mural pores, which are very numerous, regularly developed, and oval, being 0.25 mm. high and 0.19 mm. wide (or narrower); they are closely and fairly regularly spaced in the series, there being 0.125 to 0.25 mm. between the top of one pore and the bottom of the next. The septal apparatus is represented by two or more trabeculae projecting from the middle of the wall between each of the pores of a series, coalescing so as to form an eaves-like squamula with a broad and tall base and a long but narrow wedge-like projection, tapering rapidly in the vertical plane but less rapidly in the horizontal plane. The squamulae from either side of a common wall between two corallites are opposite. Septal spines projecting singly from other parts of the wall are rare. The tabulae are slightly sagging, and distant, usually with either two or three mural pores contained between two neighbours, but they tend to be developed at the same levels throughout the corallum, giving it a regularly zoned appearance.

Remarks. The possession of mural pores and septal trabeculae causes this species to be removed from *Chaetetes*. Its unusual characters, the numerous oval pores separated by squamular aggregations of trabeculae, and the regular tabular floors throughout the corallum suggest it might be wise to erect a new genus for it.

But as only two specimens are known so far, one from the possibly Couvinian Loomberah limestones of N.S.W. (the exact limestone lens is not known) and the second, G.S.V. 48541, from the upper Murrindal beds at Rocky Camp, Buchan, the species is for the moment referred to *Favosites*. I have seen no foreign species with similar characters. The Buchan specimen contains several spiral tubes, each rising about or within the wall of a single corallite, which I take to be worm tubes.

Favosites bryani Jones

(Pl. VII, figs. 23, 24)

? *Favosites squamulifera* Etheridge, 1899, p. 166, pl. XXXVIII, figs. 4, 5. Tamworth, N.S.W. Devonian, horizon and exact locality unknown, considered by Etheridge to be Woolomol Limestone because of lithological character of specimens. Type specimen not located.

? *Favosites basaltica* var. *moonbiensis* Etheridge, 1899, p. 164, pl. XXIV, figs. 1, 2; pl. XXIX, fig. 2; Jones, 1937, pl. XV, figs. 1, 2. Beedle's Freehold, near Moonbi, north-east of Tamworth, Moonbi Limestone. Type specimen not located.

? *Favosites murrumbidgeensis* Jones MS. in Allan, 1935, p. 7, pl. IV, figs. 5, 6. Holotype from Clear Hill, Cavan, N.S.W. (Couvinian Bluff Limestone), figd. Jones, 1937, pl. XVI, figs. 3-4. Allan's figured specimen was from the Couvinian Reefton limestone, New Zealand.

Favosites bryani Jones, 1937, p. 96, pl. XV, figs. 3-6, Couvinian, Goodhope and Taemas Bridge, Yass district. Hill and Jones, 1940, p. 190, pl. V, figs. 2a, 2b, Coblenzian, Molong district, N.S.W.; Jones, 1941, p. 42, pl. I, fig. 1, Couvinian, Clermont, Queensland; and a doubtful record by Hill, 1942b, p. 8, pl. II, fig. 6, from Pt. Hibbs, Tasmania.

Holotype (by designation). A.M.F.5550, Goodhope, near Yass, N.S.W., figd. Jones 1937, pl. XV, figs. 3, 4.

Diagnosis. *Favosites* with thick-walled (0.125 mm.) polygonal corallites 1 mm. in diameter, with a single median row of round mural pores (0.25 in diameter, and 0.6 mm. between centres); with the fibres of the septal trabeculae at the upper and sometimes the lower rims of pores grouped in long sharp-edged eaves-like squamulae; discrete septal spines also occur at the sides of the mural pores. Tabulae numerous, up to 18 in 5 mm., usually complete and horizontal, sometimes inclined or sagging and suspended from squamulae.

Remarks. I have been unable to locate the type specimens of the first two forms mentioned in the synonymic list above as of doubtful identity with *F. bryani*, but wish to draw attention to the possibility that *bryani* might well be related to one of them. I have examined the holotype of *F. murrumbidgeensis* (A.M.F. 9576) and find that its characters are very close to those of *F. bryani*, differing only in a slightly smaller size of corallite (0.9 mm. as against 1 mm.), in smaller mural pores (0.15 as against 0.25 mm.), and in the much higher proportion of the tabulae which are suspended from the eaves-like squamulae. The true relation between these two will only be elucidated after an exhaustive study of our Australian lower Middle Devonian *Favosites*. Since only *murrumbidgeensis* has so far been recorded from New Zealand, the two species are regarded as distinct, though both occur in the Bluff limestone of Clear Hill, Cavan, N.S.W. Only *F. bryani* is so far found in Victorian Middle Devonian beds.

G.S.V. 47763, Cave limestone (Loc. 96), has smaller corallites (0.9 mm.) and smaller pores (0.15 to 0.25 mm.) than the type, and slightly thicker walls, with neither squamulae nor spines well developed, and with somewhat less crowded tabulae, which are only very infrequently suspended from squamulae.

Melb. Univ. 1969 and 1962, from Caves Road quarry, Buchan, and G.S.V. 48436 from the Murrindal beds (Loc. 230) are all fairly close to the type specimen, and B.1 from Bindi, No. 1963 in the Melb. Univ. collection, is also attributable to the *F. bryani* plexus.

F. bryani may well have given rise to *F. pluteus* sp. nov.

***Favosites pluteus* sp. nov.**

(Pl. VIII, figs. 25, 26)

? *Favosites squamulifera* Etheridge, 1899, p. 166, pl. XXXVIII, figs. 4, 5. 'Tamworth.' Exact horizon and locality unknown; on lithology, Etheridge considered the type specimens (now missing from the Australian Museum) to be from the Woolomol Limestone.

Holotype. G.S.V. 48573, upper part of Murrindal beds, Rocky Camp, Buchan (Loc. 144) (Pl. VIII, figs. 25a-d).

Diagnosis. Corallum massive, with larger corallites 1 to 1.1 or 1.25 mm. in diameter, and with numerous wide flat shelf-like squamulae which do not vary in thickness or width from base to free edge, but project horizontally from the wall, and are frequently without close relationship to mural pores; pores uniserial, 0.25 mm. in diameter and 0.4 mm. from centre to centre. Septal spines occur near the angles of the corallites. Tabulae difficult to distinguish from the squamulae, 11 in 5 mm.

Description. The corallum is massive, the corallites being unequal, usually from 1 to 1.25 mm. in diameter. They are polygonal, usually 5- or 6-sided; the walls are about 0.1 to 0.14 mm. thick. There is in almost every intertabular space at least one wide shelf-like plate, often more than half the width of the lumen, often lying parallel to the tabulae or sometimes inclined upwards from the wall or showing a very flat curvature. These project from the wall, with the inner edge free. They are not always related to the pores, nor are they always in pairs on opposite sides of the same common wall. They do not thicken or widen towards the base, and so are different from the eaves-like squamulae in *F. bryani*. The pores are round or very slightly elongated vertically, and about 0.25 mm. in diameter; they may be as close as 0.4 mm. from centre to centre, but are often a little wider apart. They are frequently closed by pore plates, as in *F. nitidus*, *F. bryani* and *F. stelliformis*. The tabulae are flat, and strong, meeting the walls markedly at right angles; they are thick, and are crowded in some zones of the corallum; in other zones they are distant. Septal spines may project from the walls near the angles.

Occurrence. This species occurs also at Heath's Quarry, Buchan, and at Murrindal. I also have from Taemas, N.S.W., a specimen similar to those from Murrindal; in these the shelf-like squamulae are less frequent than at the type locality; there are a number of places where the squamulae are opposite on either side of the common wall; but there is little or no inclination in the squamulae, and little or no increase in thickness from free edge to walls. The Murrindal and Taemas specimens thus suggest transition from *F. bryani*.

Remarks. *F. spinigera* is described by Chapman as possessing spines thick at the base, and sharply pointed and curved squamulae; in *F. pluteus* the squamulae and spines are horizontal, and evenly thickened from base to edge. The squamulae in *F. pluteus* are flat and wide, only exceptionally curved.

Genus **Gephyropora** Etheridge; Jones, 1941, p. 51

Gephyropora duni Etheridge; Jones, 1941, p. 54

(Pl. VIII, figs. 27a, b)

Remarks. The following specimens in the Geological Survey of Victoria collection from the Couvinian Murrindal beds belong to the species: 48485, upper reef limestone, Loc. 225; 48461, Loc. 222; 48480, in reef facies in valley S.E. of Sandy's Homestead, about 800 feet above base of Buchan Series; 11778 (slides 4240, 4241) and 11768 (slide 4227), from the Buchan-Gelantipy road at Dickson's, Murrindal, opposite allot. 25B, Sec. 52; 11677 (slides 4234-6), No. 2 locality, Buchan, from a new road cutting from Buchan township to the Spring Creek Caves; the road forms the north boundary of allots. 10 and 18, Parish of Buchan.

The only foreign occurrence of *Gephyropora* is in the lower and upper Couvinian of the Ardennes. Bassler (1944, p. 42) has recently brought together scattered references to Favositidae with occasional small tubules. The Buchan material is insufficiently well preserved for studies on the wall tissue of the small tubules, such as might be expected to give evidence on whether they are corallites formed by modified polyps or whether they are due to symbiotic or parasitic growth. It should be observed that the characters of *G. duni* are, except for the tubules, very close to those of the *Favosites goldfussi* group.

Genus **Thamnopora** Steininger, 1831

Genotype. *T. madreporacea* Steininger, 1831, p. 11, Middle Devonian. Eifel = *Alveolites cervicornis* de Blainville, 1830, p. 370—see Lang, Smith and Thomas, 1940, p. 133.

Diagnosis. Ramose Tabulate corals in which the cylindrical branches may be flattened and coalesced; the corallites are typically polygonal and diverge from the axis of the branch and usually open normal to the surface; the corallite walls are dilated throughout, and the dilatation increases distally; typically the growth lamination in the sclerenclyma of the wall is obvious, while its fibrous nature is not; septal spines are usually obsolete and mural pores are large.

Range. Rather rare in the Silurian of Europe, very common in the Devonian of Europe, Asia, Australia, North America and Morocco; not known with certainty from the Lower Carboniferous, but again common in the Artinskian of Timor, India, Australia and North America, when it may show dimorphism of corallites; rare in the Triassic.

Thamnopora alterivalis (Chapman)

(Pl. VIII, figs. 28a, b)

Pachypora alterivalis Chapman, 1914, p. 309, pl. LVII, figs. 28, 29, Deep Creek, Thomson River, Gippsland. Devonian.

Holotype. Nat. Mus. 12925 (MD562), Deep Creek, Thomson River, Victoria (Devonian).

Diagnosis. Ramose *Thamnopora* with slender, finger-like branches 3 to 7 mm. in diameter, with little dilatation except distally and with few mural pores.

Description. The corallum is ramose and fasciculate, the branches being slender and cylindrical or somewhat flattened, 3 to 7 mm. in diameter, and in the Cave Limestone specimen G.S.V. 47708 (from Loc. 79) spaced from 2 to 7 mm. apart;

they are fairly regular in direction of growth, parallelism being not very marked; the branches divide dichotomously and diverge only gradually.

The individual corallites are polygonal, and attain a maximum diameter of 0.7 mm., though most are smaller, about 0.4 or 0.5 mm.; some of them are very long, growing upward and but slightly outward from the axial region for 18 mm. and then, in the last 0.5 or 1 mm. of their course, turning to open in a calice at right angles to the axis of the branch. Dilatation of the walls is small, but increases gradually distally; the walls of the actual calice above the topmost tabula of each corallite thicken more suddenly, and end in a somewhat swollen rim. The walls consist of fibres arranged at right angles to the median dark line; and in the calical parts of some corallites traces of growth lamellation are visible.

Mural pores are developed in a single series in the middle of the faces of the corallites; they are small, circular, and not common. No septa or septal spines have been observed; the tabulae are complete, horizontal or slightly concave, somewhat irregularly spaced, more crowded near the calices, and up to 2 mm. apart in the axial regions of the corallite.

Occurrence. This species is now recognized from two localities in the Buchan district, in addition to the type locality, Deep Creek. These are in the Cave Limestone (Loc. 79) and in the nodular limestone of the lower Murrindal beds of Loc. 123; the three branches shown in this younger specimen (G.S.V. 47846) are 5 mm. in diameter.

Remarks. This species closely resembles *T. reticulata* (de Blainville) of the European Devonian, which Leconte's admirable study (1939) diagnoses as typically fasciculate, with compressed or cylindrical branches to 12 mm. wide, and shallow, rounded and unequal calices 1 to 1.5 mm. in diagonal. Below the surface the corallites are polygonal, and turn sharply to open at right angles to the axis, with considerable thickening distally; with no septal spines and with mural pores 0.16 to 0.2 mm. in diameter in one series, 0.5 to 0.6 mm. apart. Leconte has discerned a very slow continuous evolution in the group from Couvinian to the top of the Frasnian; in general, the higher the stratigraphical horizon the wider the corallites and the thicker the walls. The Victorian species could well be related to *T. reticulata*; the smaller diameter of its corallites and the smaller degree of thickening it shows may indicate that it is older than the upper Couvinian, Givetian and Frasnian specimens studied by Leconte. Our species, however, shows a relatively much narrower external zone in which the corallites are at right angles to the axis and have markedly thicker walls, and for this reason it seems well to distinguish it from the European. *T. orthostachys* Penecke, 1894, p. 607, pl. X, figs. 7, 8, from the Emsian *barrandei* beds of Graz, Austria, has some similarities to our form, but is slightly larger, with somewhat thicker walls.

Thamnopora angulata sp. nov.

(Pl. IX, figs. 29, 30)

Holotype. G.S.V. 48507, upper Murrindal beds, upper reef limestone, Loc. 225, Couvinian.

Diagnosis. Dendroid *Thamnopora* with delicate branches 4 mm. in diameter, with corallites about 0.3 mm. in diameter, turning sharply outwards at the edge of a narrow axial region, directed to and opening at the surface at about 45°; the walls of the corallites thicken and the corallites widen distally to a diameter of 1.5 mm.; septal spines and tabulae are few, and mural pores small and distant.

Description. The corallum is branching, with slender branches 4 or 5 mm. in diameter, dividing dichotomously but not always in the same plane. In the holotype dichotomy occurs at fairly regular distances of 12 or 13 mm.; and the products diverge at an angle of about 30° . There is a fairly well marked division into an axial and an outer region. The axial region is about 1 mm. in diameter; in it the corallites proceed almost vertically, are about 0.3 mm. in diameter, and have common walls about 0.2 mm. thick. At the edge of this axial zone they turn sharply outwards and proceed to the surface at an angle of about 45° , their course in this outer zone being straight or only slightly curved; they increase in diameter and when they open at the surface they are slightly elongated in a vertical plane, 1 to 1.5 mm. in diameter; the openings are a little oval and separated by common walls 0.3 to 0.5 mm. thick. Septal spines are frequent, and tabulae have not been definitely identified; mural pores are round and small, 0.1 mm. in diameter and rather distant. The walls are formed of fibres directed outwards from the median dark line.

Remarks. This species is perhaps closest to the long-ranged *Thamnopora polyforata* described as *T. dubia* by Lecompte (1939, p. 120) from the upper Couvinian and Givetian of the Ardennes, which merges in the Frasnian of the Ardennes into *T. boloniensis*; it differs in its sharper distinction into axial and outer zones, and in its calices being elongated vertically rather than transversely. *Thamnopora meridionalis* Nicholson and Etheridge from the Givetian Burdekin limestone of North Queensland seems also to belong to the *polyforata* group, which has been recognized by Smith (1945, p. 64) in the Frasnian of Arctic Canada.

Localities. The species is found also at an unknown location and horizon in the Wellington district, N.S.W., but here the branches are somewhat more slender, 3 mm. rather than 4 mm., and may be reticulate, the growing point of one branch coalescing with its neighbour. A number of fragments found in the lower Murrindal beds of the South Buchan limestone quarry possibly belong to this species, although the diameter of the branches is less, 3 mm. at most, the corallites are of smaller diameter, and some tend to turn at right angles to the axis before opening at the surface.

Thamnopora tumulosa sp. nov.

(Pl. IX, figs. 31a-d)

Holotype. G.S.V. 48324, lower Murrindal beds, Loc. 183, Buchan district, Couvinian.

Diagnosis. *Thamnopora* with irregular branches up to 10 mm. in diameter, new growth sometimes encrusting old; with eight to twelve broad low septal ridges developed in the unequal calices, which are from 1 to 2 mm. in diameter; with occasional spines projecting into the lumen, and a few small mural pores, 0.1 to 0.2 mm. in diameter.

Description. The corallum is ramose, the branches being about 10 mm. in diameter, or smaller. One thin section shows an encrustation of a branch by new growth, which is relatively thin-walled. The corallites are unequal and polygonal, and curve rapidly outwards from an apparently excentric axis, to open at the surface either obliquely or, after a sudden change of curvature, at right angles. The larger corallites may attain a diagonal of 2 mm. at the surface; but most corallites are smaller, between 1 and 2 mm. In the axial parts of the branch the corallite wall is only moderately thick, there being about 0.25 mm. or less of fibrous

tissue between the lumina of adjoining corallites; the walls are equally thin in the encrustations of new growth on the branches. As the corallites diverge towards the surface of the branch their lumina increase slightly in diameter, but the common wall between them is greatly thickened up to 1 mm. In transverse sections of individual corallites, just below the calices, the common wall between two corallites shows a median dark line by transmitted light, and a median white line by reflected light; this represents the original position of contact of the polyps of two adjoining corallites at that calical level; projecting from this median line into each lumen is a thick hummocky ring of coral tissue, arranged in eight to twelve hummocks, each hummock representing a broad low septal ridge.

In most corallites the CaCO_3 of this ring is opaque and cannot be resolved into constituents; during the preparation of the thin section, cracks have frequently developed, parallel to the inner edge of the ring, curving outwards in the hummocks; sometimes perpendicular cracks have developed, separating one hummock from its neighbours. They seem to have followed original separation planes. In a few corallites one or two of the hummocks in the ring can be seen to be formed of fibres directed inwards and sideways from the mid-line of the hummock, so that each hummock would seem to represent the growth of one vertical series of trabeculae; occasionally the trabeculae have been reduced to the holacanthine condition during recrystallization. Sporadically one of the monacanth projects some distance into the lumen, appearing as a horizontal or slightly upwardly directed spine, sometimes a little spur-shaped, and tending to be elongated in the vertical plane. Where two or more such spines are seen above one another in series, which is rare, the distance between their axes is about 0.2 mm.

My interpretation of the structure of the stereozone is that it is formed of a small number (eight to twelve) of vertical ridges (septa), each consisting of one series of vertically superposed monacanth, the average spacing being about 0.2 mm. Usually the stereozone is developed to the full length of the monacanth, but occasionally the growing points of these project into the lumen.

The mural pores are small, 0.1 to 0.2 mm. in diameter; in the distal parts of the corallites they form narrow cylindrical spaces through the stereozones, at right angles to the median line between corallites. Tabulae are few, usually sagging, and irregularly spaced.

Remarks. The generic position of this species is a matter for discussion. *Striatopora*, with the Silurian genotype *S. flexuosa*, has a stereozone only in the periaxial parts of the branch, whereas *Thamnopora*, with the Devonian genotype *T. cervicornis*, has its stereozone throughout, narrow at first in the axial region, but gradually increasing in width distally. In *Striatopora* the stereozone is formed by a large number of vertical ridges each consisting of one series of vertically superposed trabeculae which are reduced to the holacanthine condition, thin, clear, recrystallized axes being surrounded by dilating tissue in which recrystallization has emphasized the growth lamellation rather than the fundamental fibres. In septal structure, then, our species differs from *Striatopora* only in degree, but in this very degree it approximates to *Thamnopora* in which also traces of the individual trabeculae are seldom discoverable. Since our species has the stereozone gradually increasing distally as in *Thamnopora*, it is included in that genus in preference to *Striatopora*, leaving for that genus those species whose septal trabeculae are typically clearly shown and in the holacanthine condition, and in which there is a sudden marked development of the stereozone in the periaxial corallites.

Family AULOPORIDAE Nicholson; Lecompte, 1939, p. 175

Genus *Aulopora* Goldfuss; Lecompte, 1939, p. 175

Aulopora cf. *conglomerata* Goldfuss (1829, pl. XXIX, fig. 4)
(Pl. IX, fig. 32)

For figure and description of *A. conglomerata* Goldfuss see Lecompte, 1936, p. 83, pl. XLII, fig. 2.

? *Syringopora auloporoides* de Koninck, 1876, p. 76, pl. III, fig. 1.

The type material was a single specimen found at Moara Creek, to the north of Tamworth, associated with *Alveolites subaequalis* Edw. and H., in bright grey dolomitic limestone. W. S. Dun considered it possible that this is the locality now known as Moore Creek, but pointed out that Attunga Creek, a few miles to the north of Moore Creek, is called Mooar Creek on an old Colony Map. The specimen was involved in the Garden Palace fire in Sydney in 1882 and has not been recovered. Etheridge (1899, p. 174, pl. XXVIII, figs. 1, 2) applied the name *S. auloporoides* to straggling coralla with corallites 1 mm. in diameter from the Woolomol limestone of Par. Woolomol, near Tamworth, and the Moore Creek limestone of Moore Creek, near Tamworth.

Description of Victorian Couvian specimens G.S.V. 48827 and 48879 (Loc. 255), 47430 (Loc. 7), from the Cave limestone, and 48698 (Loc. 237) from the Murindal beds 20 ft. above the Cave limestones. The corallum consists of a series of straggling, irregularly directed branches, sometimes adherent one to another or to other corals, or shells. The branches each consist of numerous short corallites about 3 mm. long, each corallite giving rise to another by cladochonoid increase; when not infrequently one corallite gives rise to two others by cladochonoid increase, each of the products may continue the increase, with the result that the branch consists of from one to three cladochonoid series; in such cases the series are adherent one to another. The calices open at an angle to the stem, rising 1 mm. above it, and having a diameter of about 1 mm. The proximal parts of the corallites (below the issue of the new corallite) is smaller. No lateral tubules connecting one stem to another have been observed. The epitheca is usually smooth, neither transverse growth striation nor vertical rugae being visible. In transverse section there is seen to be a moderately thick peripheral stereozone (0.2 mm.), and occasional traces of septal spines have been noted. The tabulae are concave or infundibuliform.

Remarks. The similarity in growth form between these individuals and the European Middle Devonian *A. conglomerata* is striking; our forms, however, do not show the longitudinal striation observed on the European forms.

It would appear from Etheridge's descriptions of the Tamworth specimens he used to rehabilitate de Koninck's name *S. auloporoides* that they are close to our Victorian forms; but I do not consider it possible that our Buchan specimens can belong to the same species as de Koninck's figured type specimen, for de Koninck includes in his description a reference to vertical growth of the offsets never exceeding 3 centimetres. As our offsets never exceed 2 mm. it seems that too great a difference is represented for one species.

Family SYRINGOPORIDAE

Genus *Syringopora* Goldfuss, 1826

Genolectotype (chosen Edwards and Haime, 1850, p. LXII; see Lang, Smith and Thomas, 1940, p. 130): *S. ramulosa* Goldfuss, 1826, p. 76, pl. XXV, fig. 7. ('Carboniferous' 'aus dem Uebergangskalk von Olne in Limburgischen', Germany.

Diagnosis. Compound corals with cylindrical separated corallites, typically joined by connecting tubules; with thickened walls and with septa represented by irregularly developed spines curving upwards and inwards from the wall; with tabulae deeply sunken axially, forming a syrinx-like inner tube.

Range. The genus has an extremely long range from Caradocian to Permian.

***Syringopora flaccida* sp. nov.**

(Pl. IX, fig. 33)

Holotype. G.S.V. 48878, Loc. 255, Cave Limestone.

Diagnosis. Straggling coralla with corallites up to 4 mm. in diameter, very irregular in direction and plane of growth, without connecting tubes, but occasionally adherent one to another; increase lateral, with offsets at first up to 2 mm. in diameter, old and new corallites continuing growth. Tabulae infundibuliform.

Description. The corallum is dendroid and straggling; the corallites are up to 4 mm. in diameter, with faint vertical rugae and transverse growth striation; their direction and plane of growth is very irregular, and they twine somewhat, occasionally becoming adherent one with another. No lateral connecting tubules have been observed, nor do mural pores appear to be developed at the point of contact. Increase is lateral, and not frequent; the offset begins with a diameter of less than 2 mm., and slowly expands to a maximum diameter of 4 mm.; the old corallite continues to grow after the production of the offset. Slender septal spines may occasionally be distinguished in or projecting slightly from the peripheral stereozone, which is 0.2 mm. or less in width. The tabulae are infundibuliform, but not regularly so, some plates occurring like lonsdaleoid dissepiments. The syrinx is irregular and not central.

Remarks. The species differs from the genotype of *Syringopora* and resembles that of *Aulocystis* in its straggling growth and in the apparent absence of connecting tubules. It differs from the European Givetian type species of *Aulocystis* Schluter (1885, p. 148), however, in the continued growth of the old corallite after lateral increase and is consequently placed in *Syringopora*. Arrest of the growth of the old corallite almost immediately after increase is characteristic of both *Cladochonus* and *Aulocystis*. *S. porteri* Etheridge from the Givetian Moore Creek limestone of Tamworth, N.S.W., has a similar growth habit, but its corallites are only 1½-2 mm. in diameter and have relatively much thicker walls.

Localities. In addition to specimens from the type locality, the following have been examined from the Buchan district: G.S.V. 48430 (Loc. 7); Melb. Univ. 1966, B. Ripper Coll., Spring Creek; Melb. Univ. 1965, Caves Reserve; all from the Cave Limestone; Melb. Univ. 1967, four specimens collected by B. Ripper from Citadel Rocks, Murrindal R., from an undetermined horizon; and Melb. Univ. 1964, from an unknown locality and horizon in the Murrindal district.

***Syringopora* sp.**

(Pl. IX, figs. 34a, b)

One specimen, G.S.V. 48479 (Loc. 222) from the upper reef limestone of the upper Murrindal beds of the Buchan district, Victoria, Couvinian, has corallites of 2 mm. diameter, unequally spaced (2 to 4 mm.). Connecting tubules about 7 mm. in diameter occur, but some at least of these are of a somewhat unusual type; they proceed at right angles to the corallite from which they issue until they are almost

touching a neighbour; they then suddenly turn upwards to develop as a new corallite. It was not proved, with the single specimen available, that all connecting tubules were of this type; some may have been similar to those of the genotype of *Syringopora*, by which the axial spaces of the neighbouring corallites were placed in continuity. Sections show corallites and tubules to possess a thick peripheral stereozone (0.5 mm. wide), in which holacanthine septal spines appear, directed inwards and slightly upwards. The vertical corallites possess tabulae, sometimes thickened, usually infundibuliform with the necks of the funnels forming a syrxinx, sometimes crossed by small flat plates. No tabulae have been observed in the horizontal tubules.

Genus *Roemeria* Edwards and Haime, 1851; see Leconte, 1936, p. 74

Genoholotype. *R. infundibuliformis* (Goldfuss) Edwards and Haime, 1851, pp. 152, 253, = *Calamopora infundibulifera* Goldfuss, 1829, p. 78, pl. XXVII, figs. 1a, b. Middle Devonian, Eifel district and Bensberg, Germany; see Lang, Smith and Thomas, 1940, p. 116.

Diagnosis. Basaltiform or sometimes partly fasciculate Tabulate corals; corallites with peripheral stereozone, with septal spines directed inwards and slightly upwards, with infundibuliform tabulae forming an excentric syrxinx within the lumen; and with mural pores through which the syrxinxes of neighbouring corallites are placed in continuity.

Range. Niagaran of North America, Upper Silurian of Scotland, Middle Devonian of Europe and Australia.

Remarks. There are several Australian Devonian species with the above diagnostic characters. Two of these have been previously described as *Michelinia progenitor* Chapman, 1921, p. 220, pl. IX, figs. 7, 8, from [the Middle Devonian of] Lilydale, Victoria, and *Syringopora thomii* Chapman, 1921, p. 222, pl. X, fig. 14, from [the Lower or Middle Devonian of] Loyola, near Mansfield, Victoria. The first of these has polygonal corallites in contact, with diameter from 2.5 to 3.5 mm.; the second has corallites sometimes polygonal and in contact, sometimes cylindrical, with a diameter from 4 to 5 mm. Two other species are described in this paper—both with corallites sometimes polygonal and in contact and sometimes cylindrical. One of these, *R. ocellata*, has corallites 6 mm. in average diameter, and the other, *R. sp.*, 3 mm. All these Australian forms have a remarkable horizontal wrinkling of the corallites, which causes very rapid changes in diameter of the corallites, and involves the peripheral stereozone; this is most clearly developed where the corallites are cylindrical, and the wrinklins are freely developed in the interspaces between corallites; but it is also visible in the tortuous walls of polygonal contiguous corallites. Whether the character distinguishes these Australian species from the European genotype I cannot at present determine, owing to lack of European material for comparison.

In the way in which the axial syrxinxes of neighbouring corallites are placed in communication by the mural pores, this genus resembles *Syringopora*, where the connecting tubules perform the same function; this suggests that the two are closely related.

The Gotlandian species *R. kunthiana* Lindstrom (1896) has been compared by Tripp (1933, p. 130) with *Favosites forbesi*, while Leconte doubts the propriety of referring it to *Roemeria*. The Niagaran genus *Syringolites* Hinde may be distinct from *Roemeria*, but figures are required.

***Roemeria ocellata* sp. nov.**

(Pl. IX, figs. 35a, b)

Holotype. Melb. Univ. 1955, slides 642 and 643, from the upper Murrindal beds (Couvinian) of Rocky Camp, Buchan, Victoria.

Diagnosis. *Roemeria* with large corallites (average diameter 6 mm.), sometimes prismatic, sometimes cylindrical, with horizontal expansion wrinklings involving the relatively narrow stereozone; septal spines numerous, discrete; mural pores sparse.

Description. The corallum is large, mainly cerioid, with corallites in contact and prismatic, but in patches the corallites are free and cylindrical. The average corallite has a diameter of 6 mm., but 7 mm. is sometimes observed. Transverse expansions like large wrinklings occur about 4 or 5 mm. apart in the corallites, tending to bridge the gap where corallites are not in contact, and wrinkling the common wall where they are.

The common wall between corallites is about 0.5 mm. thick, half being contributed by each corallite. Short, sharp, straight spines project from the inner edge of this wall, directed slightly upwards. They are about 0.1 mm. in diameter, and may proceed through several tabulae towards the axis. Other small spines may be developed on the upper surface of a tabula, and may then sometimes extend towards the axis through one or more other tabulae. The spines are developed in not very regular vertical series about 0.4 mm. apart, one row of spines to each series, in which the individual spines are 0.3 mm. apart; but the regularity is not great. The spines are usually seen even in the axial tube.

The tabulae are thin and crowded; they are long and steeply inclined, forming a series of incomplete and irregular cylinders enclosing a wide and irregular axial tube formed by the innermost tabulae abutting on those immediately below, and usually laterally compressed; there are nine nearly parallel sections of plates to be seen between the wall and the axial tube in a corallite 6 mm. in diameter. Mural pores are large and rather scarce, but wherever they occur the axial tubes of neighbouring corallites are continuous through the pore by means of a lateral tubule formed by the addition of the edges of the tabulae to the wall in the zone surrounding the mural pore.

Remarks. This species possesses the largest corallites of all the known *Roemeria*. The transverse wrinklings, while characteristic of all Australian *Roemeria*, have not been described in European species.

***Roemeria* sp.**

(Pl. IX, figs. 36a, b)

G.S.V. 47767 (Loc. 97) from the Cave Limestone differs from other Australian *Roemeria* in size of corallite and apparently in the large number of cylindrical corallites; but the material available at present is unsuitable for the foundation of a new species.

Diagnosis. Partly cerioid *Roemeria* with corallites 3 mm. in average diameter, with transverse wrinklings of the peripheral stereozone, which is 0.3 to 0.5 mm. wide.

Description. The corallum is partly cerioid and partly phaceloid, the corallites are cylindrical when not in contact, with small transverse wrinklings involving the peripheral stereozone; when they touch, the younger corallites accommodate them-

selves to the cylindrical form of the older corallites. The average diameter of older corallites is 3 mm., but in the only Victorian specimen most corallites were younger and smaller. The peripheral stereozone of each corallite is 0.3 to 0.5 mm. wide, and in it may be seen septal spines in a holacanthine condition, piercing a base of lamellar sclerenchyme; the spines project upwards and inwards only about 0.1 mm. from the stereozone, but others of a similar length develop on the upper surfaces of the tabulae. The tabulae are developed in two zones. The outer zone consists of large plate-like lonsdaleoid dissepiments, with long, convex inner surfaces, the lower edges of younger plates resting on the inner, upper edges of older plates; new plates tend to develop fairly evenly above the old; the marginal region of each corallite as seen in a transverse section may be divided into two to four areas by two to four such plates. The inner zone, about 0.5 mm. wide, is crossed by small saucer-like tabellae; it is seldom developed exactly in the centre of a corallite, and is usually not circular but elongate in transverse section.

Remarks. A specimen, Univ. Q'ld. F.10273, from Wellington, N.S.W., may belong to the same species as this Victorian specimen; its corallites, however, are polygonal rather than cylindrical and suggest that the two specimens may be related to *R. progenitor* (Chapman).

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Locality List for C. Teichert's Collection, Buchan-Murrindal District

(Horizons are as given by Dr. Teichert)

3. Nodular limestone in cutting of old road to South Buchan, $\frac{1}{4}$ mile south of Buchan (below Station 32); lower Murrindal beds.
7. Slope west of Fairy Creek, opposite Fairy Creek cave, about 50 ft. above bottom of creek; very low in Cave limestone.
13. Near top of Cave limestone, top of hill above Police Station, Buchan (near Station 37); near top of Cave limestone.
36. Along section of Cave limestone measured just south of southern boundary of Cave Reserve, 597 ft. above base of section; near top of Cave limestone.
55. Gelantipy road about 30 chains north of 34 (i.e., Gelantipy road about 60 chains east of big hairpin bend near Buchan (Station A9). Station A32. Murrindal beds, 850 ft. above *Gyroceratites* bed.
79. Fifty-three chains along Moon's road from corner of Orbost, Basin and Moon's roads; Cave limestone, upper part.
82. Small reef in Cave limestone in corner between Basin and Orbost roads near Station 87 (Station 94); upper part of Cave limestone.
96. About $27\frac{1}{2}$ chains along Orbost road from corner of Orbost, Basin and Moon's roads; upper part of Cave limestone.
97. Seventy links east of Loc. 96; upper part of Cave limestone.
123. = Loc. 3.
145. Gelantipy road north of Buchan, first anticline on eastern limit near axial region (Station A22); lower Murrindal beds, just below *Gyroceratites* beds.

156. Gelantipy road north of Buchan, axial part of first anticline; lower Murrindal beds.
167. $\frac{1}{2}$ mile (28 chains) north of Buchan R. bridge; beds with *Gyroceratites desideratus* in lower Murrindal beds.
177. Section of ridge east of McLarty's Homestead, 1395 ft. above porphyry; upper part of reef limestone complex of Murrindal beds.
183. Gelantipy road north of Buchan about 28 chains east of hairpin bend, a little above the horizon with *Gyroceratites desideratus*; lower Murrindal beds.
190. About $\frac{3}{4}$ mile west-north-west of Rocky Camp; somewhere in middle of Murrindal beds.
222. Gully south-east of Sandy's Homestead, 800 ft. above Porphyry series (probably somewhat higher); upper reef limestone, upper Murrindal beds.
225. Close to boundary fault, due west of Sandy's Homestead; upper reef limestone within the upper Murrindal beds.
230. On road at head of gully and immediately north of Sandy's Homestead; upper reef limestone, upper Murrindal beds.
233. Near base of Stromatoporoid reef, $\frac{1}{2}$ mile west of Murrindal School; low in Murrindal beds, probably not more than 3-400 ft. above Cave limestone.
237. On road just south of Murrindal School; lower Murrindal beds 20 ft. above the Cave limestone.
255. Gordon Hodges Gully, one chain from edge of porphyry; Cave limestone.

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